

Introduction:

- 3rd most common disease in UT
- Occurs after: UTI, Pathological condition of the prostate
- Metabolic evaluation → appropriate therapy & Life style modification → ↓ recurrence
- Without such follow-up & medical intervention → Stone recurrence can be as high as 50 % within 5 yrs
- Stones are polycrystalline aggregates composed of crystalloid & organic matrix
- Stone formation requires *supersaturation* of urine
- Supersaturation depends on (urinary pH - ionic strength - solute concentration)

Theories of stone formation:

- 1-Nucleation (crystals of FB in superconcentrated urine)
- 2-Crystal inhibitor theory: (d.t. ↓ stone inhibitor)
- 3-Crystal component & matrix component

Urinary ions:

- 1-Ca: major ion present
 - 2-Oxalate: normal waste product of metabolism, diet has impact on oxalate amount in urine
 - 3-Phosphate: key component of Ca phosphate & Mg ammonium phosphate
 - 4-Uric acid: in radiolucent stones
- *Na citrate (*Urosolvine*®): ↓ stone formation *Mg & sulfate: may help prevent urinary calculi
- **Calcium oxalate monohydrate is the **hardest** type of stones (NO ROLE FOR MEDICAL TTT)
- **Type of diet affects formation of stones (e.g. Cola drinks /Dairy products → ↑ Stone formation)

Stone varieties:

1-Ca calculi: 85%

Hypercalciuria: 3 types

- a-Absorptive b-Resorptive : in hyperparathyroidism (5-10%), need removal of adenoma
- c-Renal induced: Renal tubular defect

2-Triple phosphate:

- Struvite: 3 components (Mg, ammonium, phosphate)
- Associated with Urea splitting organism is alkaline urine -Staghorn stone

3-Uric acid calculi: 5%

- More in men -Occur with (gout - rapid weight loss - cytotoxic drugs)
- Treatment need: ▪Alkalinization of urine ▪Plenty of fluids ▪Change of dietary habits
- Radiolucent stone, appears as filling defect in IVU & ascending ureteropyelogram

4-Cystine stone:

- Inborn error of metabolism -Autosomal recessive
- Single, multiple or staghorn -Family history
- X ray: ground glass appearance -**Recurrence** is very rapid esp. if bilateral
- TTT: Plenty of fluids - Alkalinization of urine - Penicillamine - Mercaptopropionyl glycine

5-Xanthine stones:

- Radiolucent -Due to congenital defect in xanthine oxidase -TTT: Allopurinol

Symptoms & Signs:

-Pain:

a-Renal colic:

d.t. stretch of collecting system or ureter (stone → obstruction → hyperperistalsis)

-Back pressure → pressure atrophy of the kidney → renal impairment

b-Non colic:

-Distension of renal capsule -Overdistension of collecting system (due to ↑ intraluminal pressure → Stretch on nerve ends)

-Local pain is distributed distal of ilioinguinal n. and genital branch of genitofemoral n.

-Distension of collecting system: flank pain and costovertebral pain (confused with musculoskeletal pain that is related to definitive position only)

*Disappearance of pain doesn't mean stone is dissolved but further evaluation is needed

*Small stones may induce more pain than larger ones

Severity & localization of pain

-Depends on:

▪Stone size ▪Stone location ▪Degree of obstruction ▪Acuity of obstruction

▪Small ureteral stones more pain than staghorn stones

Upper ureter	Severe costovertebral pain radiating to testicles
Middle ureter	Lower quadrant pain
Lower ureter	Bladder, scrotum, urgency, burning micturition
Calyx	Obst., colic, periodic, ↑ with excess fluids, deep dull aching, mostly small stones
Pelvis	Renal radiate to flank, confused with biliary colic, nausea & vomiting

*Upper, middle ureter: flank pain, mimic acute appendicitis

In appendicitis (vomiting, constipation, healthy appearance, rebound tenderness, ↑ WBCs & ESR)

*Distal ureter: confused with torsion (iliofemoral nerve, genitofemoral n.)

*Intramural part: cystitis, urethritis, frequency, urgency, hematuria

*In ♀ DD from menstrual pain, PID

*Infection → infected hydronephrosis → fever, nausea, vomiting

Stones with pregnancy:

-Acute abdominal pain -Danger of use of radiation (Imaging, ESWL) during 1st trimester

-Care of both mother and baby -X ray with *shield* may be used

-Avoid surgery, Temporary double J or PCN to relieve pain till delivery

Stones with obesity:

-ESWL is difficult (Focal length of standard ESWL is < 13 cm)

-PCN: Sheath may be short -There is a risk of anesthesia if open surgery is needed

Stone in ectopic kidney / ureter:

-ESWL is better, but different anatomy should be considered in surgery

DD of stone on the right side:

Rt lower third: appendicitis, ectopic pregnancy, bowel obstruction

Rt upper: gall bladder stone

Risk factors:

-Crystalluria, Excess protein & fat in diet -Vegetarian -Occupation -Climate (hot weather)

Radiological evaluation:

1-Ultrasonography 2-KUB 3-IVU: shows the anatomy, bifid pelvis, double ureter

3-CT KUB without contrast: in acute renal colic, can show uric acid stones

Shows the density of the stone (help in deciding line of ttt)

4-Retrograde pyelography 5-MRU: (more tissue characterization)



Treatment:

I. Kidney & Ureter

1) Conservative (observation):

- Fluids + diuretics + analgesics + follow up
- Ureteral calculi 4-5 mm, high chance of passage
- More than 6 mm → ↓ incidence but still 1 cm can pass (distal 50%, mid 25%, prox 10%)

2) Dissolving agents:

In Uric acid (intracranial alkalinizing agent) & Cystine (Penicillamine - Mercaptopropionyl glycine)

3) ESWL:

- Size (kidney < 2 cm, ureter < 1cm) -Success rate: (upper ureter 70%, Lower 90%)
- Contraindications: pregnancy, coagulopathy, distal obstruction

4) Ureteroscopy:

- Better for lower third -Destruct stone by lithotripsy (laser, pneumatic, electrohydraulic, ultrasound)

5) PCNL:

- In renal / upper ureter stones
- Indications: -2-5 cm stone -Stones that resist ESWL -Evidence of obstruction
- Complex calculi → multiple may need sessions

6) Open stone surgery: if all lines failed

		Incision	Surgery
Kidney	Ureter	Renal incision	-Pyelolithotomy -Nephrolithotomy -Pyelonephrolithotomy
			Ureterolithotomy
	Up. third	Abernathy	
	Mid third		
	Low third	Midline suprapubic	

*Anatrophic nephrolithotomy: used for large stones (e.g. staghorn)

Metabolic evaluation: (In recurrent stones, children) to determine cause behind stone formation

- Stone analysis -24 h urine for Ca, uric acid -Serum urea creatinine, Ca phosphorus, uric acid

Bladder stones:

- Pathological condition (voiding dysfunction, urethral stone, BPH, BNO, Neurogenic, FB)
- More in poor countries / ♂ -C/O: irritative voiding symptoms, interrupted stream, hematuria, UTI
- Treatment: ▪Small: Lithotripsy, Litholapaxy ▪Large (or child): Cystolithotomy (open surgery)